The Mining Journal

AND COMMERCIAL GAZETTE.

SUPPLEMENT---X.

REVIEWS.

Birmingham and its Vicinity, as a Manufacturing and Commercial District: with illustrative plates. By WILLIAM HAWKES SMITH. Tilt, London; Radclyffes and Co., Birmingham.

[Concluded from Supplement No. IX.]

On comparing the topographical works of the present day with those of a century or two ago, or even with those of the last century, although we shall find in every respect a very marked and decided improvement, there is nothing in which this superiority will be so striking and so apparent as in the notice of the geological features and mineral productions of the district described. We shall find subjects of this kind dispatched in the most negligent and superficial manner, and while tedious pages without number are devoted to the description of buildings and antiquities, or to the elucidation of doubtful points of antiquarian research, the mines and subterranean produce are dismissed in a few hasty lines, as subjects of little interest and importance.

Much of this defect is undoubtedly to be attributed to the very imperfect state of the sciences of geology and mineralogy, and to the comparatively infant state of mining, at the period we have alluded to; yet after making every deduction, we shall still find great and singular inattention to have prevailed on these subjects. A remarkable instance of this inattention is afforded by one of our earliest and most respectable topographical writers, Camden, who, in his celebrated work describing England in the sixteenth century, gives a very brief and negligent notice of the district embraced in the work before us, as the following extract will show:—"The south part of Staffordshire hath coles digged out of the earth, and mines of iron. But whether more for their commoditie or hindrance, I leave to the inhabitants, who doe or shall better understand it." The above extract is very appropriately quoted by Mr. Smith, and affords an admirable contrast to the able and luminous manner in which he has himself treated the same subject.

It is chiefly on this account indeed that we return to the work again, and although, as we have before noticed, it possesses great merit in other respects, it is principally from its clear and pleasing description of the Staffordshire mineral district that we devote so much space to its consideration.

The descent into a coal-mine, and the general arrangement of the workings underground, are thus described by Mr. Smith, with equal spirit and fidelity:—

"The traveller, in a mineral country, will scarcely consider that he has seen all that claims his attention, unless he descend into the subterranean depths where the work is carried on. There is something novel and interesting in the act of exploring the secrets of the mine. It resembles a rapid visit to another world, or an unknown country. The trip, however, is quickly performed—without difficulty or danger; and the information required well defrays the cost of time so bestowed.

"While the trifling pre-arrangements are making for a descent, the visitor takes a rapid glance at the apparatus on the surface. Of this, the principal object is a steam-engine, of greater or less power, in proportion as the pit is more or less troubled with water,—in some cases, the contest with this enemy entirely employs a very powerful engine, so that the coals are drawn up by means of another smaller engine placed near the principal one. The water is raised by the alternate action of two pistons, which thus throw out the intrusive fluid in a continued stream. Elevated above the mouth of the working-shaft is placed a simple triangular tackling, from which, at the height of twenty to twenty-five feet, hangs a small iron wheel, over which passes the end of a long flat rope or chain, about four inches broad, which is coiled round an axis or band, moved by the engine. At the end of this chain is suspended the platform or carriage, on which the visitor and his guide place themselves, and which reposes upon the sliding head or cover of the shaft. This carriage is first raised a little in order to withdraw the wooden covering; and the shaft or pit then lies open in all its black profundity. The carriage immediately commences its descent—rapidly and silently. Casting an upward look on the failing light, the stranger's attention is arrested, to perceive that all the weight of himself, his guide, and the carriage, is insufficient to keep the rope in a state of complete tension, but that it undulates in considerable waves through its whole length. He also perceives that the shaft is filled with a thick haze or mist, which is, in fact, the accumulation of foul air, and all sorts of impurities, which are driven out of the mine by a rising current of pure air, and which thus ascend by the shaft. Darker and darker each moment becomes the shaft, and the upper orifice is now an inconsiderable circle of brightness, and still the machine descends;—down—down.

"Landing at length, after his easy transit, the visitor finds it difficult to discern the objects about him, even with the assistance of the candle which is placed in his hand—in the double blackness occasioned by the absence of light, and by the sable hue of the ribs and walls of coal by which he is surrounded.

"The floor on which he stands is the lowest measure of the *ten yard* or *main coal*, and he perceives that one or more passages or *heads*, about six feet wide, and nine or ten feet high, lie before him. Pursuing one of these, it is found to bend and slope upwards. This inclination follows *the dip of the strata*, and the shafts are usually sunk at the lowest point, in order to have the benefit of a downward path for bringing the coal, as it is dug, to the shaft. Along this passage runs a *railway* to facilitate the motion of the loaded carriages or '*skips*,' which are easily drawn *down* the descent, each by a single horse: or if the descent be considerable, they are suffered to run by their own gravitating force, along the railway;—and in this case the empty skips are returned by the action of a capstern and rope, conveniently placed at the head of the slope. In the walls, and nearly at the extreme height, are a series of apertures, twelve or thirteen feet distant the one from the other. These are communications with the '*air head*,' which runs along, level with the roof of the passage, and which is placed thus elevated because the pure air is heavier than the foul, and drives the latter away as it falls down. These passages, so necessary to the safety of the workmen, are not more than two and a half feet wide, and three and a half feet high; and along such a confined space, the skilful miner, mole-like, works his way, breaking down the coal which lies before him, and which is cleared away by boys, who follow him on their hands and knees, with baskets for that purpose.

"The *safety lamps* of Davy are sometimes used in coal mines, but by no means frequently; the guide, however, generally impresses on his charge the necessary precaution not to carry the candle too high, because 'there may be some *fire damp*, or *sulphur* in the *pot holes*,' or upper hollows.

"The mode of operation is, first to drive a passage or head to the extreme end of the area to be cleared, and then to work homeward; thus, whatever rock and rubbish are suffered to remain, are left *behind*, and the passage is still *clear*; and if any accidents or fallings in occur, they do not obstruct the subsequent progress of the miners.

"Arrived at the part where active work is going on, several candles, stuck by means of lumps of clay against the sides, shed a feeble light; and by each of these, a workman is seen pursuing this laborious occupation. It is the universal custom for the colliers, when engaged at work, to have the upper half of their bodies unclothed; thus leaving their limbs completely at liberty, and lessening the inconvenience which would be felt if fragments of coal were continually falling within their dress. Their arduous employment prevents their suffering from cold; and indeed, the temperature, at these depths, is always rather high, and receives but little variation from the changes which affect the state of the upper air.

"Noting the operation of cutting ... [illegible]

packed, while the pick or pike is constantly applied. An excavation below the stratum, perhaps eight or nine yards square, being driven—the cavity not more than two feet to two feet six inches high; the colliers next proceed to the still more difficult task of cutting *upwards*, in the sides of the impending mass, forming a channel of eight or ten inches wide, and four or five feet high, leaving here and there a small point called a *spern*, still attached to the main wall.

"The smallest coal and slack are all along carried away by boys employed for the purpose, and removed, if the work be a new one, or if there be a demand for it; but if the mine be partially cleared, and no demand exists for the small coal, it is laid in heaps, on the nearest cleared space.

"The cavity completed, it is obvious that a solid mass of coal, eight or nine yards square, and four or five feet thick, hangs, supported only by the occasional points or *sperns* before mentioned. Retiring then to a safe distance, the miners, with light poles, fifteen feet long, shod with hooks and points of steel, and termed 'prickers,' by degrees work away a portion of the support, till a slight warning crack is heard. Every one then gets out of danger, and shortly after, the vast mass thunders down. The quantity of coal which descends at a single *fall*, varies, according to circumstances, from one hundred to three hundred tons. This is then broken into removable pieces, and piled on the small low four-wheeled carriages, or skips, before alluded to, which run on the railways. The pile on the skip is carried to the height of four or five feet, by means of three or four broad iron hoops thrown over it, as necessity requires, to keep the coals in their places; and is further secured by two strong chains. When arrived under the shaft, the hook of the descending rope is attached to these chains, and the entire load, including the carriage, is drawn up.

"The lower fall of coals being thus cleared away, the miners prepare to bring down the next stage above, by cutting upwards in a narrow channel as before, as far as they can reach, leaving the requisite holds or *sperns*, in a similar manner. In this work they are partially assisted by the heaps of slack, when these are left behind; but when they can no longer reach to make their strokes, temporary scaffoldings are affixed into the perpendicular sides of the mine, by means of short and stout wedges of wood, called *byets*, which are driven into holes bored for the purpose; these byets carry planks, on whose frail and precarious footing the workmen stand, to pursue their dangerous task of detaching the enormous impending mass, which a few superfluous or injudicious strokes may bring down in resistless ruin on their heads. Such accidents, however, are of rare occurrence; practice enables the workmen to judge very accurately how far they may proceed to sap the support of the upper strata; and the weight is seldom known to fall without some notice. When the proper degree of cutting has been effected, the *pricker* is used, as in the former case, to bring down the loosened mass.

"In clearing out the coal, care is taken to leave at such distances as are thought necessary, strong pillars to support the superincumbent strata; so that when a mine of ten yard coal has been some time worked, it presents the appearance of an extensive and regular range of cavities, technically termed *stalls*, supported by massy columns of thirty feet in height.

"The arrangement of these pillars, the size of the stalls, and the measurement of the work, comparing its progress with the area on the surface, under which the mine is to extend, is the office of the *ground bailiff*, who superintends every operation, and keeps order among the often mischievous spirits who form the population of a mine.

"The springs, which sometimes abound in such quantities as to 'drown out' a coal mine, have their seat in some of the upper strata. Conducted by their veins to the open shaft, the streams of water find their way down passages or channels left for the purpose behind the brick-work, and are received into the *sump*, a deep cavity below the shaft, from whence the accumulating fluid is raised by the action of the *pumps*, which are constantly kept in motion by the *mine engine*, as already described.

"But the presence of water is not the only impediment to the operations of the *coal miner*. His progress is frequently checked, all at once, by a *fault* or dislocation of the strata, which abruptly terminates the bed of coal, till it is re-discovered above or below the previous level. These faults are sometimes simply *slips*, without much space intervening; in which case the hindrance is only proportionate to the varying depths. But sometimes a fissure of considerable width accompanies the break, filled up by foreign injected matter of igneous origin, and probably identical with the basaltic rocks which are seen at Rowley and other places. This substance, so interposed, is called by the miners *green rock*, and is frequently observable in the tables of sections referring to mines in different situations. It is also occasionally found spread out on all sides to a considerable distance, as though, in its fused state, it had insinuated itself between the strata. This green rock is so completely solid, and divested of all *grain*, or tendency to laminate, that it is with difficulty penetrated, even with the assistance of blasting with gunpowder. A shaft has sometimes to be sunk through four or five yards of this hard material, at the cost of nearly a *guinea per inch*.

"Two or more horses are employed in each colliery, to draw the carriages to and from the shaft. These animals, once lowered into the pits, seldom ascend during the space of three or four years. Their comforts are usually well attended to, and their stabling tolerably commodious, but its atmosphere is unavoidably close and oppressive.

"Such are the *notabilia*, which in different mines may address themselves to the observation, or be pointed out to the notice of the inquiring stranger, who will, in most cases, find sufficient objects of interest to engage his attention. At the close of his visit he may occupy a few minutes pleasantly, taking his station in some obscure nook, near the confluence of the subterranean ways;—watching the dim effect of the wandering lights, as they flit through the distance, or advance and recede;—listening to the always whimsical, and sometimes not a little coarse remarks of the men and boys, made in their broad, unmusical, and *lounging* dialect, as they pass and repass with the loaded and empty *skips*, and catching the vague sounds of the distant workings. Looking upward, he will perhaps be surprised to perceive the walls and roof well reticulated, by *spiders' webs*, of which some fine cables, to the extent of ten or twelve feet, undulate in the light of the elevated taper. How or why these spinners came there, or what game they expect to entrap, it were perhaps difficult to determine.

"Among other scattered hints and remarks which imperfectly reach his ear, the *new man* is made sensible that part are directed, personally, to himself, though delivered in an intonation so uncouth, and clothed in metaphor so obscure, that it is scarcely obvious that their tendency is an attack upon his purse. The occupation of these 'swart spirits' is a thirsty one; the action of *Temperance Societies*, is, as yet, confined to the denizens of upper air, and the visitor, by gracefully resigning a small portion of his loose coin, for the purchase of the ever-acceptable indulgence of DRINK, gains the 'golden opinions' of those whose work he has inspected, and retreats from the mine in good credit. Again taking his place on the magic car, his ascent is equally rapid with his previous descent, and the few minutes so consumed, are occupied in watching the effect of the gradual approach to the light of day.

"It ought to be added, that, though *steam-engines* of proportionate power are most generally used in the collieries, yet in certain situations, especially where the depth is not very great, but when the dip is considerable, and the continuance of the mine precarious, or where the quantity of water is moderate, the more ancient machine, the *gin*, is still used. In this apparatus a horse is harnessed to a large revolving horizontal bar or beam, to which is attached a *barrel wheel*, or *drum*. Round this wheel a rope is coiled, which passes over a small wheel, fixed in a wooden frame, and suspended over the pit's mouth. To the end of this rope the *skip* is attached, which is raised or depressed, according to the direction in which the horse performs his monotonous journey.

"It may be conceived that so much excavation in every direction cannot be carried on, without affecting the stability of the upper earth. It is true, as has been stated, that strong pillars are left in the coal mines; but by degrees the roofs of the cavernous spaces give way, and the failure becomes perceptible at the surface, which, in the most completely worked situations, is indented with numerous undulations, occasioned by the sinking of the ground, giving a peculiarly desolate aspect to such parts of the country. The tract of land near Wednesbury, called the *Old Coal-field*, and several considerable spaces near Tipton and Bilston offer striking instances of this. But the sinking of the ground has, as may be anticipated, seriously ruinous effects on *buildings*, which are perpetually seen in all possible degrees of slope,—the walls *mapped* with crevices and dislocations, and the door and window frames losing their rectangular form, to the great damage of the glazier's and the joiner's work. This natural effect of the loss of solid support is, somewhat equivocally, termed SETTLING. It by no means has the effect of rending the buildings uninhabitable. On the contrary, houses which almost rival, in inclination, the leaning towers of Pisa and Bologna, are considered as safe residences, and their inhabitants cling to them as long as it is possible to keep their parts together. To prevent this rapid destruction of property, a suitably *light* mode of building is occasionally adopted, and houses and public edifices of considerable magnitude may be observed,

The vast and singular limestone quarries (we might almost call them *mines*), in the neighbourhood of Dudley, which, for the magnitude and picturesque appearance of the excavations, are probably unequalled in the kingdom, are thus described:—

"The quantity of this mineral annually raised is very great, applied as it is to the several purposes of *flux* for the iron-furnaces—of *cement* for building—and for agricultural purposes, as a valuable *manure*: and the mode of working the quarries differs according to the varying position of the beds in different places. At Dudley Castle-hill, where they were earliest worked, the excavations were at first open to the light, commencing with the protruding ridges, and forming a deep hollow or ravine. This portion having been cleared, as far as was convenient, the rapid inclination of the stratum was followed, and the work continued on a lower level, in the form of dark tunnels, the course of which is generally attended by the canals, to which allusion has been made. The scenery in these caverns is, in many parts, truly grand and sublime. The cavities have all been formed by blasting with gunpowder, so that the surfaces take all the irregularities of nature; and the inclination of the strata being considerable, the occasional columns for support are left in a direction, *perpendicular to this inclination*. The hardness of the material permits the spaces to be of great width, and thus the props are seen to hang fearfully sloping across the widely yawning abyss.

"At the Wren's Nest-hill, about a mile northward from Dudley, the strata, which slope from the mines of the Castle-hill, receive a new elevation, and, as has been mentioned, incline both east and west, but at unequal angles, so that the quarrying is effected in various ways. On the *western* side, where the angle of inclination is about fifty degrees, there are three distinct stages of the mines; the upper is an extensive course of arches and columns, with the interstices open to the light. From this level descends a wide and irregular shaft to the second mine, about thirty yards deep, accessible by a chain-ladder. These quarries are both worked out of the *inner* or *lower* of the two strata of solid limestone; from the upper of the two proceeds a narrow passage or *adit*, through the intermediate measures or *bands*, to the outer face of the hill, where the rock, by the older working of the more accessible part is scarped away in a very striking manner. Here, skirting the precipice, runs a terraced road, from which descends a shaft for drawing up the lime from the *middle mine*, just mentioned, and another about seventy yards deep, which reaches the *lower working*, on a level with the canal which has been cut through the hill.

"On the *eastern* side, the angle made by the strata reaches eighty degrees, the position being nearly perpendicular. Here the accessible part of the *lower* or *inner* stratum has been long worked, and the deep deserted chasm presents a striking spectacle of silence and desolation, presiding over the bold precipitous groupings of rock, which have been, in many parts, gradually clothed with vegetation. The *upper* or *outer beds* are also in great part cleared, but are still busily worked at the lower level. The descent to the mine is by a spiral staircase, of two hundred and forty steps (about sixty yards perpendicular), at the foot of which the adventurous explorer finds himself on the banks of the Stygian canal, and his ears are saluted by the frequent explosion of the blasts. Crossing a narrow bridge of dripping and slippery plank, he gropes his way by the light of his single taper, through a narrow arched passage of considerable length, till he arrives at the scene of operation. He then stands in a stupendous hall, three hundred yards long, and from thirty to forty high, the hanging roof of which, dimly discerned, is perceived to be composed of the ragged edges of the inclined laminæ, which form the thickness of the quarry. Beyond all, an opening, high up in the rocky termination of the cavern, admits a portion of daylight, which streams, with magical softness, on the rough and jutting crags. If the workmen are engaged in the higher ranges of the mine, the effect of the volleying blasts is heightened by the circumstance of the huge descending masses, perhaps forming a total of fifty to a hundred tons weight, rolling with terrific velocity, and thundering noise, down the precipitous sides, and crashing into small fragments as they reach the floor."

Mr. Smith thus notices the mode in which the ironstone occurs, and the working of it is carried on.

"Iron-ore, or, as it is commonly called, *ironstone*, is found in several strata, both above and below the ten yard coal. In this ore, the iron is more or less copiously alloyed with argillaceous matter. It is sometimes found in continuous beds, known as *blue-flats*, *blue-clist*, and *white-stone*, but more usually in detached masses of a few pounds weight each, which are termed *balls* or *cakes*, according to the comparative roundness or flatness of their figure. These are imbedded in strata of various thicknesses, from two to six feet, and the surrounding mass is a clayey earth of considerable hardness, and called by various names, descriptive and fanciful, as *clunch*, *binds*, *ironstone-bearer*, *penny-earth*, *gubbin-stone*, *poor robin*, &c.

"These masses of iron-stone appear to be of igneous formation, for on shattering them with a hammer, the structure is frequently found to be very curious, presenting a series of crystallized portions, with spaces between each, as though the ore had cooled first *externally*, forming a shell or crust of some hardness, while the internal part in cooling, contracted, and separated into columnar sections.

"Iron is always accompanied by coal, in the mine, and is usually got out after the principal mine of coal has been raised. When a measure or stratum of iron-stone is to be worked, a *head* or passage is driven to the proposed extent; the miners, then, *work home*, as it is called; that is, they begin at the farthest extremity of the passage, loosen the entire contents of the seam with their *picks*, and select the iron-stone out of the mixed mass. The valuable ore is carried away, and the refuse is pushed back into the place it had formerly occupied. By this means the working is 'gobbed up,' as it is technically termed, though of course not so closely and firmly packed as it had previously been. The passage, or head, is, itself, supported, while the work is proceeding, by strong upright pieces of timber, carrying cross planks or bearers, which render the access secure. When the bed is exhausted, these are withdrawn, as far as can be done with safety, and the passage left to fill up by the gradual *settling* of the earth.

"Here, as in the coal mine, it is surprising in how small a space the workmen can act. If the iron-stone measure be only two feet in depth, the miner rarely cuts above or below it. If two feet six inches to three feet, he expatiates in the abundance of room which the height affords him for his laborious operations."

The iron-works and mode of making iron are next described; from this portion of the work we extract the following passages relative to the process of coking:—

"Previously to the introduction of the materials into the furnace, the ore must be calcined, or *roasted*, as it is termed; and the coal converted into coke. The calcination of the ironstone is performed in the open air, in piles of great extent, consisting of alternate layers of small coal and ironstone, to which fire is applied in various parts. The effect of this burning is to get rid of certain impurities which form part of the raw ore; as water, silex, sulphur, arsenic, &c. The loss of weight incurred in this operation is from twenty to thirty per cent.

"In the burning of coal to convert it into coke, the object to be attained is to eradicate the moisture, tar, hydrogen gas, and sulphur, with which the carbon of this mineral is attended; in fact, to render it as nearly as possible resembling charcoal. For this purpose piles are arranged, of a circular form, containing about twenty tons in each, and rising gradually to a moderate height. A chimney pipe of cast-iron, perforated with numerous holes, is placed in the centre of the pile, to expedite the combustion by the draught of air thus admitted. Fire is then applied, and the burning continues till the whole surface is ignited. It is then covered over with the dust and ashes of former fires, and left to burn out gradually. The broad flames of these coke hearths and calcining beds, contribute the greater share of that corruscating effulgence, whose flickering glances point out in the darkness of night, at a distance of many miles, the seat of our metallic operations. The loss of weight sustained in coking is more than half; one ton of coal producing only about nine hundred weight of coke.

"The calcining and coking operations are performed in an open area, closely contiguous to the furnaces, in order to avoid unnecessary labour and loss of time in removals. The works themselves are, in every possible instance, situated on the banks of a canal, in order to facilitate the transit both of the materials and of the metal. Attached to the furnace, and projecting from it, is a building of a considerable extent, called the casting-house, on the sand floor of which the fused metal is received; and where are executed those heavy castings that are, in most cases, run immediately from the furnace."

The interior of the iron-works, and the arrangements they pre-

"After the refinery, the successive processes of the forge and mill come into operation; and there are few exhibitions of mechanical power more striking and interesting than that which these present. The constant bustle and activity which thus prevail; the seeming confusion, but the real precision and order in the flitting movements of the numerous workmen and boys employed; the almost terrific appearance of the large and heavy masses of metal, rendered fiery white and plastic by the action of intense heat; flung about, played with, and changed in form by the force of hammers and rollers, under the dextrous management of practiced hands. The machinery itself, strong, but perfect; ponderous, yet in many parts delicately finished—in constantly whirring motion. The majestically tranquil motion of the shears, between whose resistless gripe large bars of iron are cut into segments, as the child snips his fragments of lead or tin. The weighty hammer, which scatters far and wide the fragments of the heated ball presented to its discipline. The apparently automatic action of the principle machines, which, in order to economise space, are generally set in motion by wheels, levers, and shafts, sunk and concealed in cavities below the iron plates which form the floor; and not least, the fly-wheel, from fourteen to sixteen feet in diameter, and weighing ten or twelve tons, whose circumference moves at the rate of nearly two miles and a half per minute, revolving, indeed, so rapidly that the spokes or radii are completely undiscernible, and the rim seems to float, a magic circle, self-supported in air. The singular effect and interest of the whole, are much heightened if the visit to the works be nocturnal. Then, the filling of the mould from the refinery, is a pyrotechnic exhibition, in which fantastic dances are performed by the brilliant stars which start from the flowing metal, on the surface of which float a multitude of blue flames from the cinder with which it is covered. The fiery balls and bars glow with an intensity which makes the unpracticed eye quail before their power, and fling, in continually changing directions, their broad masses of light and shade."

The excellent account given by our author of the history and present state of Birmingham, must here be passed over briefly, as we have already extracted largely from the work. The moral and intellectual condition of the operative classes, is a subject of much interest, their strong political bias is well known, and the sketch given by Mr. Smith contains, as we have reason to believe, a correct view both of their past and present condition.

The work is concluded by a notice of some of the manufactures carried on at Birmingham, illustrated by plates of the apparatus, &c., and written in a familiar and intelligible style, the progress of the manufactures being also traced at some length. For information on these and other subjects treated of, we must however refer our readers to the work itself, which is highly creditable both to its author and the publishers for the taste and ability displayed in its pages, and we have no doubt will obtain that wide circulation which its merits deserve. Of our own high opinion of this work, we can give no better proof than by the copious extracts we have been induced to make from it, and we recommend it to our readers, as combining matter which is equally interesting and instructive.

Medicus Magus, a Poem, in three Cantos, with a Glossary. By RICHARD FURNESS. Limbird, London; Whitaker, Sheffield, 1836.

A little volume, bearing the above title, was forwarded to us a short time since; for what reason we were rather at a loss to discover, as both medicine and astrology are sciences which have never entered into the range of "our philosophy." Neither were we much enlightened when, on opening the pages at random, many names from ancient mythology met our eye—names with which we have had but little acquaintance since, many years ago, we bade adieu to the classic fictions of Ovid and of Virgil, and commenced our acquaintance with the realities of life. On looking, however, to the preface, we found an explanation of the mystery; the Author, it appears, is either a Derbyshire miner, or closely allied to that class, and dedicates to his brethren this poetical effusion, which is intended to perpetuate certain ancient usages, customs, and phrases, which, from the anticipated exhaustion of the mines of that county, may perhaps at no distant time become extinct. We will, however, allow the Author to speak for himself, and therefore quote the following passages from his "Preface Dedicatory to the miners of the Peak of Derbyshire."

"GENTLEMEN,—Proud of my origin—being of the same stock as yourselves—with the greatest veneration for your ancient customs, in connection with your mines—the romantic scenery—abrupt precipices, barren mountains, and shrub-clad dells of the Peak, I once more venture out of the obscurity of humble life, to place under your guardianship and protection an illegitimate and wayward child of the muse.

"If the genius of antiquity confer any honour upon his descendants, you will undoubtedly occupy a very elevated niche in his temple; but the time is not far distant when your subterranean labours must terminate—when the general exhaustion of Nature's wealth will produce great and important changes in your customs and manners; and will finally bring about the extinction of such Celtic, Roman, Anglo-Saxon, and Anglo-Normanic terms as are employed by you in the working of mines and minerals: to rescue which from the wreck contemplated, many of them are incorporated with the text of the ensuing poem."

Having thus given the author an opportunity of explaining his views (we regret the remainder of the preface is very irrevalent to the subject), we may proceed to the poem itself, on which we presume it will now be necessary "to report progress." The plot being very simple, it may be worth while, in the first place, briefly to explain it to our readers.

Thor Yule, the hero of the tale, is a very respectable Derbyshire miner, uniting, as miners often do, the occupation of a small farmer with his underground pursuits. Thor is indeed quite a village genius, dexterous in various matters of handicraft, possessed of some musical talent, and of a library (we beg pardon, a collection of odd books), from which he must have acquired precisely that miscellaneous knowledge which qualified him to shine in such a sphere. From the active part we presumed Thor would take in the piece, we anticipated much amusement and exhibition of character—such a result, however, the fates denied. Thor is taken sick, and is destined to remain inactive through the poem. His affectionate wife and neighbours bring all their medical skill to bear, but in vain; his case is hopeless, and in their last extremity a messenger is dispatched to a conjuror residing at Bakewell, supposed to be skilled in the healing art, though deriving this skill from a process not remarkable for delicacy, and we must say not very creditable to the invention of the author. The messenger, Random Rider, after some trial of his nerves, during a journey by night, arrives at the magician's house, where he is played an ugly trick, being fast embraced in the arms of a skeleton till the patient's case had been considered, and the fee paid. The verbal prescription, "two ounces good of bole ammoniac," was metamorphosed by fear, or some other cause, operating on the mind of the luckless messenger into "two ounces of good old almanac." Thor's library is accordingly put in requisition, and the lucubrations of "Francis Moore, Physician," are weighed out, and boiled to a pulp, to furnish the dose, which, although its effects first bid fair to kill, in the end, by some means we do not precisely understand, effects the cure of the patient. The tale concludes by furnishing a moral, condemning quackery and superstition; and the poet indulges in certain highly philanthropic anticipations as to the state of mankind, when purged from all such erroneous ideas.

Having thus given an outline of the story, we shall, in justice to the author, give an extract or two from his work, selecting the full-length sketch of the hero, Thor Yule.

"Here dwelt Thor Yule, and Agnes good, his wife,
In deep seclusion from the din of life;
Unknown to fame, and to the world unknown,
The wedded hermits of their wilds alone;
Nor should you know these tenants of the dale,
Did not the muse record this humble tale.
Full well he look'd, nor rosy health was fled,
Though age's snow had driven on his head;
And—could we judge by wise Lavater's law—
A face more honest yet we never saw.
Low, round crown'd hats he wore, to flap inclin'd,
But for the loop and button placed behind;
Felts of his mountains' growth at Bradwell made,
Worn baldly brown by burdens of his trade:
Yet had he one reserved for better wear,
On Sunday mornings brush'd, for many a year.
Drab was his coat, the cuffs hung deep and wide,
Large metal buttons graced the dexter side
Of such his waistcoat (homespun *corduroy*),
Whose pockets elbow deep, relieved each thigh;
Unbraced, his leathern nameless things below,
Show'd round their margin linen white as snow:
Short at the knees just met his knitted hose,
And buttoning tightly, tied in equal bows:
Of kip, or steer, stout *channel pumps* he wore,
With *Bowser-buckles* broadly strapp'd before.

"On summer nights, beneath the grateful shade
Which ivy hanging from the rock had made;
Oft have I seen him, when his *shift* was done,
With neighbours seated on some favourite stone:
Pleased with the children as they play'd before
The shaggy copse that circumscribed his door;
Cheer this competitor, or that, with smiles,
Re-kindle ardour, and renew their toils;
Protect th' opprest from injury and wrong,
Support the weak, and counteract the strong.
Or if dispute outraged the laws of play,
And mirth to madness led the doubtful day;
Then would the patriarch kindly interpose,
Step in between and stay expected blows;
By wise decision cause the strife to cease,
Propose new terms and ratify a peace.

"When winter nights hung on the silent dale,
And wondering gossips listen'd to his tale:—
While Agnes with revolving ball would roll,
The yellow gleanings round her beechen bowl;—
As curfew toll'd the darksome hour in chime,
Some useful knick-knacks occupied his time:
Then would he dress a *helm*—repair a shoe,
Or scoop a ladle from a sallow's bough—
Bore *fuses*—deftly plat an osier hive—
Make *stows*, and keep the heavy hours alive:
Till nine had warn'd, when he, with toil opprest,
In holy silence sunk to balmy rest—
Rest, undisturbed by fear of future woes,
With peace the guardian of his calm repose.

"For plough and cart he own'd, a crop-ear'd mare,
That knapt the knolls and kept his pingle bare;
One brindled cow that grazed the herby dale,
At eve and morn for Agnes fill'd the pail.
Spring pluck'd him cresses from her weedy floods,
And summer—berries, from his wilds and woods;
For him brown autumn reap'd a southern hill,
And winter thrash'd, and plied for him, the mill;
His little flock supplied his warm attire;
The heather moors with turf, or peat, his fire;
Herbs, roots, plants esculent, his garden stored,
His garden half maintain'd his frugal board.
A few short pounds to save, employ'd his care,
Some half-score sheep to buy, each winter fair,
To range the cliffs, or crop the flowery steep,
Or, just to run with neighbour *Prim-Gap's* sheep:
To turn the penny—keep his country wake,
Or stop a breach which sudden flights might make.
The price of lead and wool, important things!
Weigh'd more with him than all the pomp of kings;
For well he knew that wealth's a transient toy,
Save the small sum that man can here enjoy:—
Look'd through all Nature's providential store,
Enjoy'd her simpler gifts, nor sigh'd for more.

"None had more skill in *Wapentake* or *Soke*,
To dial *drifts*, plumb *sumps*, or *take a cope*;
To cut the wond'rous rod, and thence define
The place and bearing of the hidden mine:
In *shaft*, and *scrinn*, broad-*rake*, *flatt*, *pipe*, and *vein*,
His mode of *timbering* showed all others mean;
Where *wough* or *rider*, *twitch'd a leading* fast,
'There he was matchless at a tearing *blast*:
Famed Merlin, Silence, Have-at-all, Black-hole,
Twelve-meers, and Hay-cliff, with its *cracking-whole*—
Those rocky regions, at the stated hour,
Have witness'd all the thunder of his power."

Having thus depicted the honest miner, it would hardly be gallant of us to pass without notice "Agnes good, his wife." Here, then, is a sketch of the lady, evidently done *con amore*.

"Turn and behold her! once the village pride,
John's earliest love, and still attractive bride:
Love—not that transient passion of an hour,
Which dies when marriage sanctifies its power;
But the sweet bond, that in the blest abodes,
Unites the minds of angels, or of gods;
Lit at the fount of life, the mutual flame
Burns in the tyrant and the slave the same,
And beams as brightly round the rustic names
Of country matrons, as of courtly dames:
In the deform'd or beauty's eye will glow,
Pure at the Cape as polish'd Fontainbleau.
Though Malthus scorn the loves of humble life,
As bright a jewel is the poor man's wife,
As was Augusta, by her sovereign Lord,
By Roman realms or by the world adored.

"Beneath a spar where hung her handy reel,
She bent attentive to her noisy wheel;
A crate of hazles held the carded wool:
With elder spindles—sycamore her spool,
And level hand, she drew the silver line,
Where wool and flax in equal parts combine;
Plain was her habit, neat in every part,
The wholesome fabric of her thrifty art;
While Thor's impervious doublet, stitch and plait,
Stout hose, and linen, *praised her in the gate*.
Prudent and chaste, alike industrious, clean,
Reserved, yet friendly, frugal, but not mean:
To strangers kind, in conversation free:
Think what a good wife is, and such was she."

It is by no means our wish to criticise the little poem before us, which lies extremely open to "the ungentle craft;" we believe the author is a man of some talent, and we therefore offer him our advice in kindness and good feeling. We fear his prevailing sentiment is precisely the converse of Pope's celebrated axiom, "whatever is, is right," and have been sorry to see his work injured by so many unnecessary outbursts of this feeling, both in the poetry and the notes. We would recommend him to look on society, notwithstanding its defects, with more kindly eyes; to study human nature as he sees it exhibited around him, with more attention, and books, especially those in which he seems chiefly to delight, with less, and we have little doubt he will hereafter produce something far superior to his early efforts. The life and habits of the miner present an hitherto neglected, but by no means unpromising field, for poetical description; in this he appears well qualified to labour, we think with success, and we hope not without benefit to himself.

EXTRACTS FROM FOREIGN SCIENTIFIC WORKS.

No. II.

CONSIDERATIONS ON THE PRESENT STATE OF THE GLOBE, AND THE CAUSES FROM WHICH THE EJECTION OF PYROGENOUS ROCKS HAS ORIGINATED.

Having commenced our series of extracts from foreign scientific publications, by a novel and curious illustration of volcanic action, we cannot better continue it than by giving the following general view of this important subject, taken from the same work, the "Traité de Geognosie," by M. D'Aubuisson de Voisin. Our readers will find the opinions at present entertained with regard to the origin of volcanic phenomena, very clearly and briefly explained in the extract we now lay before them:—

On considering the history of volcanic phenomena, we must arrive at the conclusion, that those which now take place only form the last of a long series of igneous ejections, occurring from the period when this planet first took its station under its present astronomical conditions; and consequently the origin of this action must have an intimate connexion with the physical or chemical construction of the globe. The problem of volcanic eruptions, separately considered, observes M. Elie de Beaumont, is limited to the discovery of the causes, either chemical or otherwise, producing an orifice in the exterior crust of the globe, extending downwards to a liquid mass of lava, impregnated with all the substances which appear, on its cooling, at the surface of the earth.

The momentary or permanent existence of this mass being once admitted, either within or underneath the crust of the globe, and a channel of communication being supposed between it and the surface, M. Beaumont conceives the mechanism of eruptions to be as follows: the gaseous substances, whose presence in the liquid mass is attested by the white vapour evolved from its surface until its total induration, constitute the principal mechanical agency in these emissions. When a portion of the interior mass comes in contact with the external parts, these gases being evolved from all points of the mass which are not too remote from the orifice itself, expel through the aperture that part of the same mass, which is become lighter in consequence of the numerous gaseous bubbles which pervade it, and give it a cellular or spongy structure.

This phenomenon is analogous to what takes place, when a fermented liquor escapes from the vessel containing it.

When, however, we consider volcanic districts in general, we are led to attribute the ejection of igneous rocks to a more general and powerful agency than that of gas; which is dubious in basalt, where the compactness is so uniform, and perhaps altogether inadmissable in masses of a very loose nature, which have risen from, rather than flowed upon the surface. In passing, step by step, over these igneous districts, we sometimes find an augmentation of volcanic energy; and sometimes, on the contrary, an increase of opposing force, which has evidently been presented to the expansive power pressing outwards.

The only question therefore, to be decided is, whether volcanic action results from chemical or dynamic phenomena? Recent observations have so modified this subject, that the question may be thus proposed: do igneous phenomena arise from the *oxydization* of the successive strata composing the globe, as Sir Humphrey Davy supposed; or, in conformity to the opinion of Humboldt, from the action of the interior of a planet, still in fusion, upon its solid or oxydized crust; that is to say, is it a mere process of cooling or refrigeration.

M. Arago has recently approached this question, by the method of a theorem to be demonstrated: At the first origin of things the earth was an intensely heated body, and at the present period retains, in its solid crust, a perceptible part of its primitive heat. If, says M. Arago, the earth had been already solid when it began to revolve upon its centre, it would have retained the form it then possessed, nearly unchanged, notwithstanding its rotatory motion. This could not be the case on the contrary supposition. A fluid mass necessarily takes the form of equilibrium corresponding to all the forces acting upon it; and it is theoretically shown that such a mass, supposed at first homogeneous, must become flatter in the direction of the axis of rotation, and increase in breadth at the equator; and the results of this hypothesis coincide remarkably with the numerous admeasurements of the earth in both hemispheres. Such a coincidence cannot be the result of chance; and we may thence conclude, that the earth was originally in a fluid state. Whoever reads attentively the description given of volcanic districts, will feel no doubt respecting the nature of this fluidity, for, since we find volcanic formations increasing in number and in power, the more we examine those masses which are almost entirely crystalline, and seem to form a general crust on the globe, it cannot be doubted that the original fluidity was igneous. The earth is accordingly in a state of cooling, more or less advanced, a proposition which M. Arago has demonstrated by considerations purely physical. Supposing, he observes, that the earth derived all its heat from the sun; the calculation founded on this hypothesis would show, first—that at a certain epoch the temperature would be invariable; secondly—that this solar temperature of the interior of the globe, would change with the latitude. According to this theory the temperature of the strata in every climate should be the same at all depths, which is well known not to be the case, as experiments have given a result of one degree (centigrade), for every twenty or thirty mètres; and it is, therefore, beyond a doubt that the regular augmentation of temperature the farther we penetrate the interior of the globe, cannot result from any other than original or proper heat. M. Arago has since demonstrated that this *refrigeration* has been proceeding for a very considerable period of time, in comparison of which the æras of recorded history are a mere trifle. In short, he has proved from astronomical considerations, that, in the space of 2000 years, the general temperature of the earth has not varied the tenth part of a degree.

It being once demonstrated, that, at a certain distance from the surface of the globe, all the rocks must be in fusion; and by the law of the progression of the temperature, above cited, this distance must be at the utmost sixty kilomètres, (thirty-seven and a half English miles), what may we conceive to be the mechanism of igneous eruptions?

The hypothesis which ascribes volcanic formations to the reaction of water on metallic alkalies, or on the sulphurets and chlorides of metals, cannot be maintained, on a careful examination, since, notwithstanding the immense quantity of steam emitted during an eruption, joined to the hydrochloric acid of Vesuvius, Vulcano, &c., it is found that a great num-

ber of the volcanoes afford neither hydrochlorates nor chlorides, nor yet hydrochloric gas, and that the gases evolved are chiefly steam, sulphuric acid, a little carbonic acid, azote, and others, purely accidental. We do not meet with such a quantity of hydrogen as must arise in the event of oxydization by means of aqueous decomposition. Again, if we consider the gradual augmentation of caloric from the surface of the globe to the liquified rocks, it will be evident that water, at so inconsiderable a depth as that in which it is presumed to react, can only exist in the form of steam, which, having always a tendency to rise, could only come into contact with the lavas after they had risen in the volcanic orifices ; and, moreover, as steam is a recent phenomena, few traces of which appear in the basaltic, and still fewer in the trachytic period, it may be concluded that the evolution of steam is caused by the proximity of the sea.

The distribution of volcanic masses is precisely the fact which operates most powerfully in favour of the dynamic system ; for if, instead of considering this distribution in relation to the seas, we view it in reference to the accidents of the land in relief over the surface of the globe, to which accidents the waters themselves undoubtedly owe their distribution, we arrive at these remarkable results, first, that volcanoes have generally appeared on the elevated ridges of continents and chains of mountains ; and, second, that the volcanic action is in an inverse ratio to the developement and continuity of continental masses, which have, consequently, served to exhaust the expansive power and form an equilibrium, which could not have been produced by the *elevation* of consolidated masses.

The emission of igneous rocks is not the only effect produced on the surface by the refrigeration of the globe. To the same dynamic influences may evidently be ascribed those movements of the earth, both by elevation and depression, which must have had so important an influence in former geological periods, and which present two different results arising from the same cause."

ON THE LAVA FORMATIONS ON THE BANKS OF THE RHINE.

In the following extract the remarkable volcanic district of the Rhine is described, and it will be seen that this district affords some curious illustrations of the connexion between cellular and basaltic lavas :—

The lava formations on the Rhine constitute a decided approach to the basaltic formation ; and this relation arises here not merely from the nature of volcanic productions which oscillate continually between basalt and modern lava, but also from the peculiar form produced by volcanic agency. The districts of Eiffel and Neuwied present both lava and basaltic volcanoes, and the distinction between the two is often very difficult to establish. The whole country between the Rhine, the Moselle, the forest of Ardennes, and the plains eastward of Cologne, exhibit phenomena in exact accordance with those of ordinary lava. Conical mountains, composed of ejected substances and scoria of lava, surmounted by craters, have emitted streams of cellular lava ; but peculiar accidents of the soil have varied this aspect ; there are circular depressions, vast crateriform hollows, appearing not on conical elevations, but on a level with the plains and table land, which are composed of clay-slate, greywacke, or limestone forming the prevailing rocks of that region. Some of these crateriform depressions are nearly a league in diameter, and have naturally become receptacles of water, forming circular lakes. The surface of these depressions is generally covered with loose scoria ; they seem to have been craters produced by violent gaseous eruptions, such as are denominated craters of explosion.

Steininger, the, the geologist of Treves, divides the craters of Eiffel into three classes, the first producing only scoria and pazzolana, apparently formed by simple explosion ; secondly, those which have emitted scorified fragments, sometimes cemented together ; and thirdly, such as have emitted currents of lava as well as detached fragments. The number of the craters of Eiffel altogether amount to nearly thirty. It is probable that these volcanic orifices are the result of an uninterupted series of eruptions, during the period of transition from the lava to the basaltic formation. The Volcano of Mosenberg is the most striking instance of this transition. Near the centre of the plain of Mosenberg, says Mr. Reynaud, there rises a conical hill with a crater in perfect preservation and which has emitted a brown spongy lava. To the south-east of this crater, and nearly in contact with it, is another in a state of complete decay ; farther on is a third, well defined, although indented on one side by a stream of lava which had flowed into the valley beneath ; the lower part of this stream exhibiting the dark appearance and compact prismatic structure of basalt. Thus these craters, which may be considered as geognostically contemporaneous, have produced, the one modern and spongy lava, and the other a basaltic lava ; a fact which coincides with the hypothesis of the succession of different lavas. The volcano of Gerolstein seems the best adapted to throw light on the geognostic question here involved.

The village of Gerolstein, observes M. Reynaud, is commanded by a tabular eminence, of an irregular circular form, about one English mile and a quarter in diameter, composed of limestone, containing trilobites, &c., and terminating on every side in abrupt precipices. In the centre of this plain is a conical crater, whose sides are covered with a greyish brown lava, very rough and very porous ; this crater has been formed in calcareous deposits, and has given a passage to a vast quantity of lava, which, passing over the plain, has precipitated itself in form of a cascade into the valley. The most interesting fact of this locality is, the connexion existing between the emission of the lava, and the transformation of a part of the limestone into dolomite. In fact, the limestone in the vicinity of the lava, says M. Reynaud, becomes crystalline, and dolmitic, and these characteristics are the more striking, the nearer they approximate to each other. At the same time the stratification disappears, there appear large vertical fissures, which impart to rock a peculiar character. In the interior of the lava, a calcareous mass has become cavernous, and the fossils of this mass only cease to appear in those parts which are most altered ; and in proportion as the mass is more distant from the lava, the limestone resumes its compact texture, and other characteristics."—*Traité Geogn.*, vol. iii. p. 80.

ON THE NATURE OF THE ERRATIC BLOCKS IN THE NORTH OF EUROPE.

We conclude our present extracts by the following notice of the erratic blocks which form so curious a feature in the geology of northern Europe :—

If we consider the alluvial phenomena of northern Europe, we find they present a novel and remarkable feature. Erratic blocks, for which it were easy to account when found on the Alpine slope, here appear with much greater frequency, and in situations far more anomalous. These blocks, generally of several cubic yards content, and frequently of some hundreds, are found in innumerable instances throughout Sweden, Russia, and the whole of the low and sandy plains bordering on the Baltic Sea, and even on the German Ocean, to the Weser and the Ems. These masses are not scattered irregularly, but extend longitudinally, for the most part from north to south, being met with in the midst of sandy plains, and found, on examination, to be rocks of primary formation, as granite, syenite, porphyry, gneiss, &c. Near Groningen, they are so deeply buried in the sand, that boring is employed to find them. Towards Königsberg their direction and whole appearance denote that they have derived their origin from the mountains of Sweden, and the researches of Brongniart and Haussmann confirm this opinion.

Thus, in the latter country, these masses abound, forming series of hills, in Smoland, Upland, Scania, and Sudermania, in the direction of north-north-east to south-south-west. On crossing the German Ocean, similar blocks appear in the same direction through all the maritime districts of Zealand, Pomerania, Holstein, Westphalia, and even in Mecklenburg. The observations of Razoumovsky, who traced them as far as between Moscow and Petersburg, present the same results, he having found their direction from north-east to south-west, and ascertained them to be mineralogically indentical with the Scandinavian blocks. The shock which first propelled these bodies, seems to have been so great, as to transport them into England as far as the counties of Norfolk, Suffolk, York, and Derby.

But however vast the force must have been to produce these effects, it can only be ascribed to a great local inundation or debâcle ; if we suppose the accumulated waters on an immense surface, directed towards the south by movements of the soil, equal to those which have determined the formation of the northern maritime basins, who can calculate the enormous force of such a mass of waters, even if the declivity passed over were only a few hundred yards? To such local inundations, or very prolonged aqueous superincumbency, the formation of alluvial deposits must be ascribed ; and in cases where the former have acted upon rocks containing gems, metalliferous ores, or native metals, these currents have effected a denudation, in some cases beneficial to mankind.

These substances have been more able, from their superior hardness, to resist trituration than other rocks, so that at present they may be obtained by washing ; and again, the native metals, by their malleability and tenacity, have resisted a friction, which has dispersed, or, as it were, annihilated many other minerals : gold and platina are thus circumstanced. The destruction of immense masses of quartz in the Brazils, appears to have produced the alluvial deposits so rich in gold and gems, covering the extensive valleys and low table land of that country ; and these alluvial deposits, which occur again in Colombia, contain also gold, platina, palladium, and diamonds.—*Traité de Geognosie*, vol. ii. p. 613. (*Nov. 16.*)

CARN BREA—MINING OPERATIONS.

(*Continued from No. 62.*)

Before we take up that portion of the mining history of Carn Brea, which stands connected with the Romans, it may be well to observe, that both the Greeks and Phœnicians may be reckoned among the benefactors of Cornwall. With regard to the latter, it is allowed on all hands, that they sought neither glory nor conquest from their visits to the Cornish shores. The sword was left to rust in the scabbard, the arrow lay motionless in its quiver, the bow was unstrung, and the shield and buckler were laid aside. They fought no battles with our ancestors, nor erected any trophies of victory on the Cornish soil. On the contrary, they came under the benign influence of the olive-branch of peace, to benefit and to be benefited ; and their salutary influence on our ancestors, tended to soften their rude and barbarous manners, and to lay down the basis of civilisation, of art, and of science. They readily purchased of the ancient Cornish their tin, together with such other articles as they were free to dispose of, and supplied them with the necessaries, the comforts, and even many of the luxuries of civilised life. So salutary indeed was the influence of these accomplished foreigners on our ancestors, that, in those parts where it was most prevalent, their manners, customs, and language became almost assimilated ; and on their departure, the ancient Cornish estified their gratitude by continuing to call their chief places of resort by the names they had given them. It is, moreover, a fact well worthy of notice, that not a few of those places bear their Phœnician appellations to the present day, as Hamoaze, Meneage, Godolphin, and many others. It is equally a fact, that the Cornish *Tre*, *Pol*, and *Pen*, are derived from the same source ; and it is notorious, that the rock idols which in other countries are of well-known Phœnician origin, bear an almost exact resemblance to those still extant on many Cornish hills ; and it is an undoubted fact, that this ancient people paid their adorations to similar deities on the summit of Carn Brea.

The Grecian intercourse with our ancestors bore much of the character as that of the Phœnician. Actuated by the same motives, and influenced by the same principles, they assumed the like peaceable demeanour. Having become partners with the Phœnicians in the lucrative tin trade of Cornwall, they were assiduous to possess and to retain the good opinion of its inhabitants ; and for this purpose, they conducted their commercial intercourse so as to meet their approbation. But having had a shorter, and, of course, less extensive intercourse with our ancestors than the Phœnicians, they naturally made and left a less extensive impression on the customs and manners of Cornwall. Yet, even to the present day, we are not altogether destitute of evidence of their social intercourse in the names given by them to several places, which appellations they still retain. It is also notorious, that although an almost incredible improvement had taken place in the mien and dress of our ancestors through their intercourse with the Phœnicians, inasmuch as they had doffed their habiliments of skin, and ceased to paint their bodies, and had enveloped their persons with comparatively graceful drapery, girt about their waists and extending down to their ancles. Yet, at first sight, they appeared to the more polished Greeks like the representatives of a host of tragic furies ; hence they gave the appellation of "Œstromenides" to Scilly and Cornwall, which implies the "Isles of the Furies."

Before quitting this part of our subject, we will briefly advert to an incident which befel the enterprising Grecian who first found his way to the Cornish shores. After a protracted voyage of adventure, hardship, and peril, the celebrated Pytheas actually pushed his way to, or, as some say, beyond the Cornish coast, where for the first time he saw a thick fog, in which the land and water, together with their animate and inanimate contents, appeared reflected, as in a mirror. Nature reflected, suspended and swimming in a fog, was a phenomena, for which the Greek, with all his philosophy, could not account, and for which he sought an explanation from the natives, who readily accounted in their own way for a phenomena then, as now so prevalent in the vicinity of Carn Brea.

(*To be continued*).

Anemometer.—The *Athenæum* states that Mr. Follet Osler has presented to the Philosophical Society of Birmingham, a self-registering instrument of this name, by means of which a constant registry is kept, not only of the direction, but also of the force and velocity of the wind. A self-registering rain-guage is also attached to it, which notes the quantity of rain, and likewise the precise moment when it falls.

Liege Cannon Foundry, Belgium.—This establishment is one of the largest in Europe. It comprises two foundries on an extensive scale, and twelve high blast furnaces ; eight more than the largest in France. Besides these, there are two large smithies, with fifteen furnaces, and a large smelting place. The bellows are impelled by five steam engines. The present director of the works is a Major Frederix, a nephew of General Haguinin, by whom they were restored to their existing state of efficiency at the close of the war in 1816. They were set on foot in 1804, and since General Haguinin took them under his care they have supplied the Dutch Goverment with nearly 4000 cannon, for land, sea, and garrison purposes. At the present day iron-casting is executed here as well as metal casting ; the former is said to be equal to the Swedish in quality.

IRISH MINING OPERATIONS.

[*Continued from No. 67.*]

Sir,—As it is generally difficult to calculate the time it will require to complete the sinking of deep shafts, it is usual till they are down, to continue sinking the old whim and engine shafts on the under side of the lode ; this is of course attended with considerable wear of timber, chains, kibble, &c., and increased friction to the engine in drawing and pumping. A shaft where the circumstances of ground, as to hardness, and distance of the workings from its direction will admit, is very much forwarded by driving cross-cuts from such levels as are deemed advisable, and on their arrival at the shaft, by setting additional miners to sink and rise through the under portion of it, the holing of these levels is also most useful in bringing air to, and carrying off the water from the shaft ; where a shaft is required to be sunk so far distant from the workings of a mine, and to cut the lode at a much greater depth than the mine is yet worked to, it has been the custom to sink it of large dimensions, and carry down a casing or dividing of boards sufficiently air-tight to cause a free circulation of that indispensible element, but the plan lately adopted in this country, when shafts are required so far off in new ground, is to sink two shafts of moderate dimensions within two or three fathoms of each other, connected at every twenty fathoms by short drivings, this, on calculation has been found the most expeditious and economical plan in sinkings so circumstanced, besides the great advantage in having two shafts instead of one. When these shafts are down the work proceeds as before described, and the various "backs," or "breasts" between levels, are stoped away with such speed or spirit, as the view of ore and price in the market will induce. By the time a Mine has attained this extent, the machinery generally has become of great power, and the various means of pumping water, drawing, crushing, and stamping the ores, &c., of great strength, magnitude, and importance. It is perhaps unnecessary to describe separately, these departments, as the principle of them all is pretty much the same, being wrought by steam-engines, where water-power cannot be procured ; and it is a pleasing fact, that the capabilities and superiority of the steam-engine over any other power is becoming well understood in the mines of this country, and the very laudable emulation to economise fuel, which prevails with such success among the mine-agents and engineers in Cornwall, is also extending to Ireland, and we have now numerous proofs of the saving to be effected by the state of perfection this machine has been brought to. The minor departments in Irish mines, such as cobbing, bucking, jigging, are quite similar to the plans pursued in the other mines of the United Kingdom, with the exception of but little of the work being done by the women and girls ; this in some measure originates in the great plenty of male labourers to be had, and the moderate rate of wages, not being sufficiently encouraging to the females, together with a little aversion on their part to active exertion. The establishment of crushing-mills and washing-machines has been of very valuable service in dressing the ores, serving not only to dispatch a large quantity in a short space of time, but to repress and keep down combinations among the dressers, who generally form the largest portion of the population of a large mine ; and the plan now generally used of properly laying lodes open, and keeping down the "sump," or reservoir, from which the pumps take their water, as much under the various levels, backs, or stopes, as possible, has brought about increased facilities to the miner in breaking the ore, and by preventing the frequent "hindrances" he formerly had to contend with, has enabled him to "make wages" at a much lower price per ton than formerly given. It was not unusual some years ago to see several sinkings going down, perhaps within five or six fathoms of each other, without any bottom level being in progress to communicate with them, so that each sinking had to lift its water by hand, and frequently the water of the others, thereby "beating" water several times over ; and, in cases where the engine-shaft sump has been at a higher level, a further expense of manual labour has had to be incurred to get the water up to the pumps ; this, with the breakage, stops, and frequent disappointment to the miner, formerly operated much against the success of Irish mines. A spirit of competition in bidding at the bargain settings is at last established in this country, which has been mainly promoted by the great number of miners, who may be said to have learned their business during the last fifteen years ; but, as yet, the greater number of them being bad judges of the value or price of the labour to be done ; where there is much anxiety for employment, care has been used in preventing their undertaking their contracts at such a rate as will prevent them from executing them. On the other hand, where the competition is not great, there is sometimes difficulty in convincing miners of the fairness of the price offered. One great disadvantage to the Irish miner is, his ignorance of the enonomy and good management of his stores, as he and his partners must in the course of a month consume a large quantity of gunpowder, candles, iron, steel, and other small materials, together with incurring the indispensable charges of drawing and dressing his ore, as also his smith's cost ; it may easily be perceived, that his attention to these points is very essential to promote his own good earning, as also indirectly the prosperity of the mine he works in. On looking over the average earnings of large number of miners, I have ascertained, that with those who have gained small wages it has been generally more attributable to this than to any deficiency in the price, in mines where the agents exercise proper and just discretion in striking out the rates that the different "pitches" can be worked for. The rate of wages at which the Irish miner appears to be content to work hard is, from fifty shillings to three pounds per month, and overground labourers from twenty-four to forty shillings.

E. B.

NORTH CAROLINA GOLD MINES.

The following statement, which we copy from the *Rutherford North Carolina Gazette*, seems to remove the impression that the Southern Gold Mines are becoming exhausted :—

Bechtler's Gold Coin.—Mr. Bechtler has politely furnished us with the subjoined statement of money coined by him from the 18th of January, 1831, to the 12th December, 1835, together with the amount of gold fluxed during the same period. Most of the gold was taken from the mines in Rutherford and Burke counties, although much of it is stamped Georgia gold. The subjoined statement extends no later down than the 12th Dec., 1835, but since that time, instead of a falling off, there has been an increase of business. We paid him a visit last Saturday, when he had just polished off the last \$3000 for a day's work. Mr. B. has promised to furnish us with a statement of the amount coined and fluxed since that period, at as early a date as possible.

STATEMENT OF THE AMOUNT OF GOLD COINED AND FLUXED BY C. BECHTLER, NEAR RUTHERFORDTON, N.C.

Amount coined in \$5, \$2½, and \$1 pieces, from the 18th Jan., 1834, to 22d Dec.	\$109,732½
Ditto, from the 22d Dec., 1834, to the 12th Dec., 1835	695,895
Total	\$805,627½
Number of dwts. fluxed from 18th of Jan., to 22d Dec., 1834	395,804
Ditto, from the 22d Dec., 1834, to the 12th Dec., 1835	711,533½
Total	1,107,337½

These statements prove the immense extent of the mining interest in this section of the State. We do not know what proportion this forms to the amount collected from the mines—perhaps a half, perhaps not one-fifth : yet mining has not fairly commenced with us.

Extraordinary Fossil.—Mr. Craig has been able to make another very valuable addition to the palæontological collection of the Andersonian museum, being a fossil, apparently the hinder extremity of a reptile. It is only a portion of the fossil, the other part not yet having been extracted from the roof of the coal in which it was found. The portion in the museum is about four feet long, and three inches in diameter. The integument, or coating, is converted into coal, the interior into the carbonate of iron. The fossil seems to belong to the annelide, consisting of rings like the common earth-worm, and containing the transverse furrows peculiar to that class of animals. The coating is of considerable thickness, and its being of a carboniferous substance is the only objection that presents itself to Mr. C. to its being an animal remain. If a vegetable, the objections seem tenfold, for from another specimen found by him in the same pit, the head, not unlike that of a common serpent, was completely developed, as the tail is in this ; the fossil, besides, widens in the middle. It is well worth the attention of the curious. Mr. C. is in hopes of being able to get both of the remains entirely extracted, and means, we believe, to exhibit it at the Andersonian soirée on Monday evening.—*Glasgow Liberator*.

USE OF HOT-AIR IN IRON WORKS.

In our last Supplement we treated the hot-blast at considerable length in our review of M. Dufrenoy's work on that subject; we consider it, however, so important to diffuse as much information as possible respecting this improvement, that we now give a further notice of its application. The following paper was read before the Royal Society of Edinburgh, by Thomas Clarke, M.D., Professor of Chemistry in Marischall College, Aberdeen, and treats with considerable ability, "on the application of the hot-blast to the manufacture of cast iron," giving also a remarkable clear and simple explanation of the theory of this process.

Among persons interesting themselves in the progress of British manufactures, it can scarce fail to be known, that Mr. Neilson, of Glasgow, manager of the gas-works in that city, has taken out a patent for an important improvement in the working of such furnaces as, in the language of the patent, "are supplied with air by means of bellows, or other apparatus." In Scotland, Mr. Neilson's invention has been extensively applied to the making of cast iron, insomuch that there is only one Scotch iron-work where the invention is not in use, and in that work, apparatus is under construction to put the invention into operation. Apart from the obvious importance of any considerable improvement in the manufacture of so valuable a product as cast iron, the invention of Mr. Neilson would merit attention, were it only for the singular extent of the improvement effected, compared with the apparent simplicity—I had almost said inadequacy—of the means employed. Having, therefore, by the liberality of Mr. Dunlop, proprietor of the Clyde iron-works, where Mr. Neilson's invention was first put into operation, obtained full and free access to all information regarding the results of trials of the invention at those works, on the large scale of manufacture, I cannot help thinking that an authentic notice of these results, together with an attempt to explain the cause of them, will prove acceptable to the Royal Society of Edinburgh. And that these results, as well as the cause of them, may be set forth with clearness, I shall advert,

1st. To the process of making iron, as formerly practised.
2d. To Mr. Neilson's alteration on that process.
3d. To the effect of that alteration.
4th. To the cause of that effect.

I. In proceeding to advert to the process of making cast iron, as formerly practised, it cannot here be necessary to enter into much detail in explanation of a process, long practised and extensively known, as this has been; nor, indeed, shall I enter into detail, farther than to the general scientific reader may be proper to elucidate Mr. Neilson's invention.

In making cast iron, then, the materials made use of were three—the ore, the fuel, the flux.

The ore was clay iron-stone, that is to say, carbonate of iron, mixed, in variable proportions, with carbonates of lime, and of magnesia, as well as with aluminous and silicious matter.

The fuel made use of at Clyde iron-works, and in Scotland, generally, was coke, derived from splint-coal. During its conversion into coke, this coal underwent a loss of fifty-five parts in the hundred, leaving forty-five of coke. The advantage of this previous conversion consisted in the higher temperature produced by the combustion of coke, in consequence of none of the resulting heat disappearing in the latent form, in the vapours arising from the coal, during its conversion into coke.

The flux was common limestone, which was employed to act upon the aluminous and silicious impurities of the ore, so as to produce a mixture more easy to melt than any of the materials of which it was made up, just as an alloy of tin and lead serves as a solder, the resulting alloy being more easy to melt than either the lead or the tin apart.

These three materials, the ore, the fuel, and the flux, were put into the furnace, near the top, in a state of mixture. The only other material supplied was air, which was driven into the furnace by pipes from blowing apparatus, and it entered the furnace by nozzels, sometimes on two opposite sides of the furnace, sometimes on three, sometimes, but rarely, on four. The air supplied in this manner entered near the bottom of the furnace, at about forty feet from the top, where the solid materials were put in. The furnace, in shape, consisted, at the middle part, of the frustums of two cones, having a horizontal base common to both, and the other and smaller ends of each prolonged into cylinders, which constituted the top and bottom of the furnace.

The whole of the materials put into the furnace, resolved themselves into gaseous products, and into liquid products. The gaseous products, escaping invisibly at the top, included all the carbonaceous matter of the coke, probably in the form of carbonic acid, except only the small portion of carbon retained by the cast-iron. The liquid products were collected in the cylindrical reservoir, constituting the bottom of the furnace, and there divided themselves into two portions, the lower and heavier being the melted cast-iron, and the upper and lighter being the melted slag, resulting from the action of the fixed portion of the flux upon the impurities of the fuel and of the ore.

II. Thus much being understood in regard to the process of making cast iron, as formerly practised, we are now preparing for the statement of Mr. Neilson's improvement.

This improvement consists essentially in heating the air in its passage from the blowing apparatus to the furnace. The heating has hitherto been effected by making the air pass through cast-iron vessels, kept at a red heat. In the specification of the patent, Mr. Neilson states, that no particular form of heating apparatus is essential to obtaining the beneficial effect of his invention; and, out of many forms that have been tried, experience does not seem to have yet decided which is best. At Clyde Iron-Works, the most beneficial of the results that I shall have occasion to state, were obtained by the obvious expedient of keeping red-hot the cast-iron cylindrical pipes conveying the air from the blowing apparatus to the furnace.

III. Such being the simple nature of Mr. Neilson's invention, I now proceed to state the effect of the application.

During the first six months of the year 1829, when all the cast iron in Clyde iron-works was made by means of the cold blast, a single ton of cast iron required for fuel to reduce it, eight tons one and a quarter cwt. of coal, converted into coke. During the first six months of the following year, while the air was heated to near 300° Fah., one ton of cast-iron required five tons three and a quarter cwt. of coal, converted into coke.

The saving amounts to two tons eighteen cwt, on the making of one ton of cast iron; but from that saving comes to be deducted the coals used in heating the air, which were nearly eight cwt. The nett saving was thus two and a half tons of coal on a single ton of cast-iron. But during that year (1830) the air was no higher than 300° Fah. The great success, however, of those trials, encouraged Mr. Dunlop, and other iron-masters, to try the effect of a still higher temperature. Nor were their expectations disappointed. The saving of coal was greatly increased, insomuch that, about the beginning of 1831, Mr. Dixon, proprietor of the Calder Iron-Works, felt himself encouraged to attempt the substitution of raw coal for the coke before in use. Proceeding on the ascertained advantages of the hot-blast, the attempt was entirely successful; and, since that period, the use of raw coal has been extended so far as to be adopted in the majority of the Scotch iron-works. The temperature of the air under blast had now been raised so as to melt lead, and sometimes zinc, and therefore, was above 600° Fah., instead of being only 300°, as in the year 1830.

The furnace had now become so much elevated in temperature, as to require water around the nozzle of the blow-pipes, a precaution borrowed from the finery-furnaces, wherein cast iron is converted into malleable, but seldom or never employed where cast iron is made by means of the cold blast. What is called the *Tweer*, is the opening of the furnace to admit the nozzle of the blow-pipe. This opening is of a round funnel-shape, tapering inwards, and it used always to have a cast-iron lining, to protect the other building materials, and to afford them support. This cast-iron lining was just a tapering tube nearly of the shape of the blow-pipe, but large enough to admit it freely. Now, under the changes I have been describing, the temperature of the furnace near the nozzles, is such as to risk the melting of the cast-iron lining, which, being essential to the *tweer*, is itself commonly called by that name. To prevent such an accident, an old invention called the *water-tweer* was made available. The peculiarity of this tweer consists in the cast-iron lining already described being cast hollow instead of solid, so as to contain water within, and water is kept there continually changing as it heats, by means of one pipe to admit the water cold, and another to let the water escape when heated.*

During the first six months of the year 1833, when all these changes had been fully brought into operation, one ton of cast iron was made by means of 2 tons 5¼ cwt, of coal, which had not previously to be converted into coke. Adding to this 8 cwt. of coal for heating, we have 2 tons 13¼ cwt. of coal required to make a ton of iron: whereas, in 1829, when the cold blast was in operation, 8 tons 1¼ cwt of coal had to be used. This being almost exactly three times as much, we have, from the change of the cold blast to the hot, combined with the use of coal instead of coke, *three times as much iron made from any given weight of splint coal.*

During the three successive periods that have been specified, the same blowing apparatus was in use; and not the least remarkable effect of Mr. Neilson's invention, has been the increased efficacy of a given quantity of air in the production of iron. The furnaces at Clyde iron-works, which were at first three, have been increased to four, and, the blast machinery being still the same, the following were the successive weekly products of iron during the periods already named, and the successive weekly consumption of fuel put into the furnace, apart from what was used in heating the blast:—

	TONS.		TONS.		TONS.
In 1829, from 3 furnaces,	111	Iron from	403	Coke from	888 Coal
In 1830, from 3 furnaces,	162	Iron from	376	Coke from	836 Coal.
In 1833, from 4 furnaces,	245	Iron		from	554 Coal.

Comparing the product of 1829 with the product of 1833, it will be observed that the blast, in consequence of being heated, has produced more than double the quantity of iron. The fuel consumed in these two periods we cannot compare, since in the former coke was burned, and in the latter, coal. But on comparing the consumption of coke in the years 1829 and 1830, we find, that although the product of iron in the latter period was increased, yet the consumption of coke was rather diminished. Hence the increased efficacy of the blast appears to be not greater than was to be expected, from the diminished fuel that had become necessary to smelt a given quantity of iron.

On the whole, then, the application of the hot blast has caused the same fuel to reduce three times as much iron as before, and the same blast twice as much as before.

The proportion of the flux required to reduce a given weight of the ore, has also been diminished. The amount of this diminution, and other particulars, interesting to practical persons, will appear on reference to a tabular statement supplied by Mr. Dunlop, and printed as an appendix to this paper. Not further to dwell on such details, I proceed to the last division of this paper, which is,

IV. To attempt an explanation of the foregoing extraordinary results.

Subsidiary to this attempt, it is necessary to discriminate between the quantity of fuel consumed, and the temperature produced. For instance, we may conceive a stove to be kept at the temperature of 500° Fah., and lead to be put into such a stove for the purpose of being melted. Then, since the melting point of lead is more than 100° higher, it is evident that whatever fuel might be consumed in keeping that stove at the temperature of 500°, the fuel is consumed to no purpose, so far as regards the melting of lead, in consequence of deficiency in the temperature. In the manufacture of cast iron likewise, experience has taught us, that a certain temperature is required, in order to work the furnace favourably, and all the fuel consumed so as to produce any lower degree of temperature, is fuel consumed in vain. And how the hot blast serves to increase the temperature of a blast furnace, will appear on adverting to the relative weights of the solid and of the gaseous materials made use of in the reduction of iron.

As nearly as may be, a furnace, as wrought at Clyde Iron-Works in 1833, had two tons of solid materials an hour put in at the top, and this supply of two tons an hour was continued for twenty-three hours a day, one half-hour every morning, and another every evening being consumed in letting off the iron made. But the gaseous material—the hot-air—what might be the weight of it? This can easily be ascertained thus: I find, by comparing the quantities of air consumed at Clyde Iron-Works, and at Calder Iron-Works, that one furnace requires of hot air, from 2,300, to 3,000 cubical feet in a minute. I shall here assume 2,867 cubical feet to be the quantity; a number that I adopt for the sake of simplicity, inasmuch as, calculated at an avoirdupoise ounce and a quarter, which is the weight of a cubical foot of air at 50° Fahr., these feet correspond precisely with 2 cwt. of air a minute, or *six tons an hour.* Two tons of solid material an hour, put in at the top of the furnace, can scarce hurtfully affect the temperature of the furnace, at least in the hottest part of it, which must be far down, and where the iron, besides being reduced to the state of metal, is melted, and the slag too, produced. When the fuel put in it at the top is cold, I have no doubt that, before it comes to this far-down part of the furnace—the place of its useful activity—the coal has been entirely coked; so that, in regard to the fuel, the new process differs from the old much more in appearance than in essence and reality. But if two tons of solid material an hour, put in at the top, are likely to effect the temperature of the hottest part of the furnace, can we say the same of six tons of air an hour, forced in at the bottom, near that hottest part? The air supplied, is intended, no doubt, and answers, to support the combustion; but this beneficial effect is, in case of the cold blast, essentially counteracted by the cooling power of six tons of air an hour, or 2 cwt. a minute, which, when forced in at the ordinary temperature of the air, cannot be conceived otherwise than as a prodigious refrigeratory passing through the hottest part of the furnace, and repressing its temperature. The expedient of previously heating the blast obviously removes this refrigeratory, leaving the air to act in promoting combustion, without robbing the combustion of any portion of the heat it produces.

Such, I conceive, is the palpable, the adequate, and very simple explanation of the extraordinary advantages derived in the manufacture of cast iron, from heating the air in its passage from the blowing apparatus to the furnace.

Marischal College, Aberdeen, Jan. 10, 1835.

APPENDIX.—The blowing-engine has a steam cylinder of forty inches diameter, and a blowing cylinder of eight feet deep and eighty inches diameter, and goes eighteen strokes a minute. The whole power of the engine was exerted in blowing the three furnaces, as well as in blowing the four, and in both cases there were two tweers of three inches diameter to each furnace. The pressure of the blast was two pounds and a half to the square inch. The fourth furnace was put into operation after the water-tweers were introduced, and the open spaces round the blow pipes were closed up by luting. The engine then went less than eighteen strokes a minute, in consequence of the too great resistance of the materials contained in the three furnaces to the blast in its passage upwards.

Materials constituting a Charge.—1829, Coke, 5 cwt.; roasted ironstone, 3 cwt. 1 qr. 14 lbs.; limestone, 3 qrs. 16 lbs.—1830, Coke, 5 cwt.; roasted ironstone, 5 cwt.; limestone, 1 cwt. 1 qr. 16 lbs.—1833, Coal, 5 cwt.; roasted ironstone, 5 cwt.; limestone, 1 cwt.

Table shewing the Weight of Cast Iron produced, and the average weight of Coals made use of, in producing a ton of Cast Iron, at Clyde Iron Works, during the years 1829, 1830, and 1831, the Blowing Engine being the same.

COKE AND COLD AIR. 1829	Weekly product of Cast Iron by three Furnaces. (tons cwt qs.)	Average of Coals used to 1 ton of Cast Iron. (tons cwt qs.)	COKE AND HEATED AIR. 1830	Weekly product of Cast Iron by three Furnaces. (tons cwt qs.)	Average of Coals used to 1 ton of Cast Iron. (tons cwt qs.)	COAL AND HEATED AIR. 1833	Weekly product of Cast Iron by four Furnaces. (tons cwt qs.)	Average of Coals used to 1 ton of Cast Iron. (tons cwt qs.)
Jan. 7	137 18 2	8 12 1	Jan. 6	176 10 2	5 2 2	Jan. 9	375 8 0	2 12 3
14	148 2 0	6 9 2	13	181 12 2	5 0 2	16	267 18 0	2 4 2
21	148 8 2	6 11 2	20	172 5 2	5 0 2	23	270 7 2	2 3 1
28	138 9 2	7 0 2	27	178 7 0	4 19 0	30	250 9 0	2 4 0
Feb. 4	125 13 0	7 12 1	Feb. 3	164 8 0	5 4 0	Feb. 6	265 3 2	2 1 0
11	136 19 0	7 13 1	10	172 12 0	5 4 0	13	202 10 0	2 4 3
18	130 16 2	7 11 2	17	163 9 0	5 9 0	20	257 1 0	2 4 3
25	105 12 2	7 10 0	24	170 1 0	5 3 0	27	264 0 0	2 5 1
Mar. 4	101 8 1	7 17 2	Mar. 3	154 19 0	5 10 3	Mar. 6	234 13 0	2 5 2
11	111 2 0	8 2 2	10	154 16 0	5 9 2	13	238 7 2	2 7 1
18	114 10 0	7 6 2	17	151 8 2	5 9 3	20	205 13 0	2 10 2
25	110 14 0	8 8 1	24	163 17 0	5 5 1	27	217 14 0	2 2 3
Ap. 1	111 4 0	8 7 2	31	163 8 2	5 11 0	Ap. 3	220 7 0	2 14 2
8	107 7 0	8 3 0	Ap. 7	147 10 0	5 7 0	10	280 9 2	2 0 3
15	91 12 2	8 15 0	14	154 9 2	5 2 0	17	304 7 0	1 17 3
22	85 13 0	9 13 0	21	163 4 0	4 19 9	24	248 12 2	2 3 0
29	91 14 2	9 6 2	28	148 12 2	5 4 0	May 1	245 7 2	2 6 0
May 6	92 7 2	8 8 2	May 5	162 10 2	5 2 2	8	200 17 0	2 8 0
13	94 6 0	9 2 1	12	149 13 0	5 3 2	15	246 4 2	2 5 3
July 8	88 4 2	8 16 3	19	162 4 0	5 5 0	22	219 1 2	2 6 0
15	91 13 0	8 5 0	26	165 7 2	4 18 3	29	231 2 0	2 8 0
22	97 2 0	8 2 1	June 2	160 4 0	5 2 2	June 5	235 16 0	2 6 2
29	104 15 2	7 10 2	9	157 17 0	5 1 0	12	232 10 0	2 7 1
Aug. 5	106 17 2	7 7 2	16	164 0 0	4 17 3	19	271 1 2	2 1 0
12	93 1 0	8 6 0	23	149 3 0	4 18 0	26	262 3 2	2 3 1
19	113 7 0	8 18 2	30	162 16 2	4 16 3	½ w. 30	122 16 0	2 5 1
	2878 18 0	309 19 0		4215 6 0	134 6 2		6390 3 0	58 18 3
Av.	110 14 2	8 1 1		162 2 2	5 3 1		245 0 0	2 5 1

FOSSIL CAVE.—The *Frankfort Post-Ampt Gazette* gives the following from Hohenzollern-Sigmaringen:—"In the course of last summer the Pastor Stehle, minister of the parish of Borenthal, discovered at the foot of Mount Henberg de Sigmaringen, a grotto 400 feet in length, and extremely remarkable both in a geological and geognostical point of view. The entrance is situated towards the east, amongst rocks, from the fissures in which grow a quantity of boxwood. The grotto contains a species of hall 100 feet long, in the direction of the west; this hall communicates towards the south with another division, also 100 feet in length. The sides, which are formed of snow-white stone, are marked with regular excrescences in the form of drops, and resembling ornaments, executed with taste and care. A third large hall, which is also 100 feet in length, communicates with the preceding by a large and lofty aperture extending from east to west. The *ensemble* of these halls resembles a Gothic church, with a part of the dome in a dilapidated state. In the direction of the south is a wide fissure, which forms a sort of well, 150 feet in depth, and in which have been found human bones, and those of inferior animals. M. Stehle has called this grotto Carlshœhle (grotto of Charles), after the name of his sovereign. On the same level are three other grottoes, distant from each other only two leagues; that of Carlshœhle, as we have before stated, is 400 feet long; the grotto of Kœnigsheimer is 318 feet in length, that of Kolbinger 400, and that of Mulheimer 350 feet."

CAST IRON PIPES.—Sir John Herschell, in his letter to M. Arago, says, that the pipes which convey water at Cape Town are liable to be stopped up as they are at Grenoble. Mr. Chisholme, the engineer, had remedied this inconvenience by putting a thin layer of Roman cement on the interior surface of the pipe—a plan which was suggested by Sir John Herschell himself.

COMMUNICATION OF HEAT.

CALORIC IS COMMUNICATED BY CONDUCTION AND RADIATION.

(From Dr. D. B. Reid's "Rudiments of Chemistry.")

When caloric passes slowly from one portion of matter to another in contact with it, it is said to be conducted, and the process is termed the conduction of caloric. Metals are the best conductors, then liquids, and lastly gases. Gold, silver, and copper are the best conductors among solids; glass, bricks, and many stony substances, are very bad conductors: and porous, spongy solids, as charcoal, hair, and fur, are the worst.

Put one end of an iron rod in the fire; the heat soon passes through it, and along its particles to some distance from the fire. Put a glass tube or piece of wood of the same size as the iron into the same part of the fire; the heat extends a very little beyond the part touching the fire, both these substances being bad conductors.

Clothing is generally made of bad conductors, that the heat of the body may not be conducted quickly to the surrounding air. Furnaces, where great heat is required, are built with porous bricks, which are very effectual in preventing the escape of heat; but when a stove is placed in the middle of any apartment, the fuel is surrounded with iron, that the heat may be quickly conducted to the air. The ice in an ice-house is surrounded with blankets or straw to prevent the warm air coming too easily in contact with it.

When heat is applied to the upper portion of any liquid, expansion generally ensues, and it becomes lighter than the rest: it remains, therefore, resting upon the colder and heavier part. This may be easily shown by boiling the upper portion of water in a long glass tube, applying heat by a spirit lamp. If the heat be applied near the bottom of the tube, the colder portion from above soon sinks below the hot expanded fluid, and pushes it up, so that currents are continually produced, till the whole fluid is heated to the same point.

Similar movements take place in the air.

Caloric is said to be radiated when it passes with great velocity from the sun, or from any warm body at the surface of the earth, moving through space or through the air. It is believed in this case to move with the same velocity as light, viz. 192,000 miles in a second. Caloric is also radiated from warm bodies that are not luminous, as from the hand, or from hot water.

Radiant Caloric is absorbed when it falls upon bodies having painted or rough surfaces, such as are presented by bricks and other porous solids, by many kinds of stony matter, and numerous animal and vegetable substances, and elevates their temperature as it is taken up. But brilliant and polished metallic surfaces absorb little heat; they reflect or turn it back again.

Take a piece of common tin plate, and place it before the fire; it reflects most of the radiant heat, and becomes warmer with extreme slowness. Make the surface rough with a file or sand-paper, cover it with lamp-black, or black paint; it now absorbs heat quickly when exposed to the fire, and soon becomes warm.

Those bodies which are most powerful in receiving radient heat when it falls upon them, are equally powerful in emitting it when they are warmer than surrounding objects. Thus, a vessel with hot water, having a rough, porous, or painted surface, cools much more quickly than when the surface is brilliantly metallic.

All bodies at the surface of the earth lose heat by radiating in a clear evening; they radiate more or less heat, according to the nature of the surface; those that radiate most become colder than the others, and on these more dew or hoar-frost is deposited, the air coming in contact with them being cooled to the greatest degree, and unable, therefore, to retain all the moisture previously associated with it. The green leaves of vegetables are powerful in radiating heat, and are accordingly covered with the dew during the night, which is so necessary to plants when there is no rain.

In a cloudy night, as heat does not escape by radiation from the surface of the earth, the temperature never falls so much as in a cloudless sky.

ENGLISH INDUSTRY IN SCIENTIFIC RESEARCHES.—Of the fifty-five simple substances recognised in physics, twenty-two—and of the forty-five metals, seventeen—have been discovered in England. Our countrymen may plume themselves, if they please, on this fact. We sincerely wish that they could lay claim to an equal proportion of the whole of the great physical laws, and of the formulæ by which those laws are expressed; the results of profound analytic investigations, based on carefully-repeated experiments, and requiring more intensity of mental exertion than the discovery of a new body, which is most commonly fortuitous.

PRIMARY COUNTRY.—When we take a bird's eye view of a primary country, the surface very commonly exhibits a system of valleys, which run parallel with the central ridge of granite; and these longitudinal valleys are intersected by others, which cross them at right angles; and as the intermediate hills are more or less rounded, the surface of the country has an undulating appearance in both directions, which has been often and aptly compared to the waves of the sea; and the simile is further appropriate, inasmuch as, when the curves of the hills are regular and gentle or variously contorted or abrupt, they resemble the sea when agitated by the wind with different degrees of violence.

INROADS OF THE SEA ON THE COAST OF CARDIGANSHIRE.—The whole of this ocean amphitheatre (Cardigan Bay) was formerly dry land, and the greater portion remained so until the sixth century, when Gwyddue Garnabir was the reigning prince of the district. It was named Cantrey y Gwaelod, the Lowland Hundreds, and is mentioned by the Welsh bards and historians (indeed the terms are synonymous) as being fertile and beautiful in the highest degree, and containing sixteen fortified towns, and a large population. This fine champagne country extended from Harlech to St. David's Head, and was wholly destroyed by an inundation of the sea, the waters of St. George's Channel having burst over their wonted boundaries, and covered its entire extent. Thus was formed the present Bay of Cardigan, whose deep blue waves now roll over many a ruined city and once mighty fortress, lying in irretrievable desolation beneath them. It seems probable, that a sudden sinking of the land aided the inroad of the sea, even if the latter event were not wholly caused by the former, which appears likely. The present gradual advancement of the sea on this western coast might well lead to the belief of these ancient traditions, even if better proof were wanting; but in several places, and more especially at Borth, a few miles north of Aberystwith, when the tide is out, stumps of trees are seen in numbers in the sand, proving the former existence of a great forest on the spot. The wood when dug out is hard, and black as ebony. I am informed by a friend residing at Aberystwith, that a tradition respecting the existence of a great castle on a spot now six miles out in the bay, opposite that place, has lately been rather singularly verified by the Admiralty surveyors; they have found stones on the precise spot which bear evident signs of having been used in masonry. We cannot but anticipate still further loss of land in the valleys washed by the ocean in this neighbourhood; nor do the mountain barriers themselves offer any very enduring resistance to its mighty strength, for, being wholly composed of splintery slate rock, they fall in large masses. The Castle Hill forms a favourite promenade for the visitors at Aberystwith, from its commanding and picturesque situation; but each year so much reduces its seaward cliffs, that they and their hoary ruin-crest must eventually be swept away. The base of this small promontory is completely caverned by the breakers that dash and foam, and thunder in its hollow sides, making most dread but "eloquent music," and flinging their light spray over the sea-beat cliffs.—*Roscoe's Wanderings in South Wales.*

POPULATION OF PARIS.—Various estimates of the population of Paris have been made at different periods, but the following calculation is, it is believed, from accurate data. In 1590, although the population had been reduced by religious wars, it was about 200,000. It increased much under Henry IV. and Louis XIII. In the latter part of the reign of Louis XIV., it was about 510,000; in 1762 it was 576,000; in the reign of Louis XVI. the number of inhabitants was 600,000; in 1805 it was 547,750; in 1817, 713,966; in 1827, 890,431; in 1831, 774,338; in 1832 it was calculated at 770,280; and according to the last census, the population was nearly one million; so that it has been almost doubled in the course of thirty one years.—*Athenæum.*

* An incidental advantage attended the adoption of the water-tweers, inasmuch as these made it practicable to lute up the space between the blow-pipe nozzle and the tweers, and thus prevent the loss of some air that formerly escaped by that space, and kept up a bellowing hiss, which, happily, is now no longer heard.

London: Printed and Published by HENRY ENGLISH, the Proprietor, at his Office, No. 12, Gough-square, Fleet-street, in the city of London; where all Communications and Advertisements are requested to be forwarded, post paid. [December 31, 1836.]